Document List

Advisory Committee on Advanced Television Service
Technical Subgroup

TS - #	Document Description	Action
001	Letter from Richard E. Wiley to Advisory Committee re: Announcement of Grand Alliance and Plan to Utilize Techincal Subgroup, dated May 24, 1993.	Noted
002	List of Appointed Technical Subgroup Members, Ex Officio Participants, and Observers, dated June 24, 1993.	Noted
003	Grand Alliance Technical Proposal, dated June 4, 1993.	Noted
004	Letter from Joseph A. Flaherty to Grand Alliance Technical Committee Forwarding Comments on Grand Alliance Technical Proposal Received from Various Technical Subgroup Members, Participants, and Observers, dated June 8, 1993.	Noted
005	Minutes of Meeting June 30 - July 1, 1993	Revised
005 (Rev.1)	Minutes of Meeting June 30 - July 1, 1993	Approved 08/11/93
006	Agenda of Meeting June 30 - July 1, 1993	Approved 06/30/93
007	Grand Alliance Presentation Charts (first page: "The Grand Alliance System"), dated June 29, 1993.	Noted
008	Grand Alliance Presentation Charts (first page: "Video Compression")	Noted
009	Letter and Questionaire from George Vradenburg III, Chairman of the Economics Experts Group, dated July 14, 1993.	
010	Grand Alliance Answers to Technical Subgoup Questions (see TS-004)	
011	Letter from Richard E. Wiley to Technical Subgroup re: method of review and schedule, and formation of Joint Experts Group, dated July 23, 1993.	
012	Augmented Experts Group Membership List, sub letter from Joseph A. Flaherty, dated July 26, 1993.	
013	Minutes of Meeting August 11, 1993	Pending
014	Draft Agenda of Meeting August 11, 1993, sub letter from Joseph A. Flaherty, dated July 22, 1993.	Revised
014 (Rev.1)	Agenda of Meeting August 11, 1993	Approved 08/11/93
015	FCC Public Notice re: Copy Contractor (source for Technical Subgroup Documents)	Information
016	Audio Experts Group Chairman's Report	
017	Grand Alliance Report: Audio (titled "Grand Alliance Summary of Specialist Group Activities")	
018	Grand Alliance Report: Transport	

071

019	Interoperability Joint Experts Group Chairman's Report	
020	Experts Group on Economics Preliminary Survey Results, dated August 11, 1993.	
021	Chairman's Report: Scanning Formats / Compression Expert Group	
022	Grand Alliance Report: Format Issues	
023	Transmission Expert Group Chairman's and Grand Alliance Specialist Group Report	
024	Grand Alliance Report: Weighting Factors for Transmission System Selection	
025	Technical Subgroup Master Calendar (labeled "draft"), dated August 11, 1993	Revised
025 (Rev.1)	Technical Subgroup Master Calendar (labeled " "), dated August **, 1993.	Approved 08/11/93
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TS-001

Docket 87-268

WILEY, REIN & FIELDING

RECEIVED

SEP 20 1993

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

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RICHARD E. WILEY
(202) 429-7010

May 24, 1993

Dear Members of the FCC's Advisory Committee on Advanced Television Service:

I am pleased to report that, as of today, the remaining ATV system proponents have entered into a "Grand Alliance" that will produce a single, merged system. A press release that will be released at a late afternoon press briefing today is enclosed.

The Grand Alliance proposal will be reviewed as soon as possible by our Technical Review Subgroup, co-chaired by Joe Flaherty and Irwin Dorros. If the concept is acceptable, the proponents will proceed to build the modified system. Thereafter, that system will be subjected to both laboratory and field testing. Sometime in 1994, I hope that our Committee will be in a position to review the test results and to make a system recommendation to the FCC.

The Grand Alliance proposal contemplates that, initially, a dual transmission format (facilitating both progressive and interlaced scanning) will be employed. However, all of the proponents endorse the goal of migrating to a thousand-line plus progressive scan transmission format and eliminating interlaced scanning as soon as feasible.

I believe that the Grand Alliance, combining the best elements of the remaining systems, should produce a very advanced HDTV system. Moreover, because all of the proponents have endorsed the proposal, it also should minimize possible challenges to whatever determinations our Committee and the FCC ultimately make and, thus, expedite the introduction of advanced television in our country.

I will keep you advised of any further developments. Please call me if you have any questions concerning this entire matter.

Sincerely,

Dick

Richard E. Wiley
Committee Chairman

REW/eth

Docket 87-268

TS-002

Advisory Committee on Advanced Television Service

---- Technical Subgroup Membership ----

Co-Chairs

1. Irwin Dorros (Bellcore)
2. Joseph Flaherty (CBS)

Other Members

3. Lynn Claudy (NAB)
4. Birney Dayton (NVision)
5. Alex Felker (Time Warner Telecommunications)
6. Branko Gerovac (Digital Equipment)
7. Michael Haley (IBM)
8. John Henderson (Hitachi America)
9. Robert Hopkins (ATSC)
10. Renville McMann (Consultant)
11. Mark Richer (PBS)
12. Robert Sanderson (Eastman Kodak)
13. Craig Tanner (CableLabs)
14. Victor Tawil (MSTV)
15. George Vradenburg (Fox)

Ex-officio Participants

1. Robert Eckart (FCC)
2. Peter Fannon (ATTC)
3. James Gaspar (Panasonic)
4. Reggie Gilliam (IBEW)
5. George Hanover (EIA)
6. Paul Hearty (ATEL)
7. Brian James (CableLabs)
8. Robert Niles (Capital Cities/ABC)
9. Richard Prodan (CableLabs)
10. Charles Rhodes (ATTC)
11. Peter Smith (NBC)
12. Lawrence Thorpe (Sony)

Observers

1. Carol Darling (Advanced Broadcasting Systems of Canada)
2. Kenneth Davies (SMPTE)
3. Keiichi Kubota (NHK)
4. Howard Miller (PBS)
5. Victor Rojas (Televisa)
6. George Waters (EBU)

June 24, 1993

Docket 87-268

General Instrument

General Instrument Corporation
VideoCipher Division
6262 Lusk Boulevard
San Diego, California 92121
Tel 619 455 1500 Fax 619 535 2486

June 4, 1993

Mr. Joseph A. Flaherty
Chairman Technical Subgroup
Advisory Committee
51 West 52nd Street
35th Floor
New York, NY 10019

Dear Joe:

On behalf of the "Grand Alliance" we are pleased to submit to you the initial technical description of our proposed system.

We look forward to working with the Technical Subgroup to assist in the evaluation.

Sincerely,

Robert M. Rast

Robert Rast
Vice President

RMR/tn

cc:
Carlo Basile/Philips
Bill Beyers/Thomson
Don Leonard/AT&T
Jae Lim/MIT
Wayne Luplow/Zenith
Woo Paik/GI
Glenn Reitmeier/Sarnoff

THE GRAND ALLIANCE SYSTEM

The parties of the Grand Alliance recognize that each previously proposed system demonstrated particular strengths in the ACATS testing and evaluation process. In the spirit of developing the best HDTV standard for the U.S., the Grand alliance system combines the advantages of all of the previously proposed digital systems.

Highlights of the Grand Alliance HDTV system include:

- Flexible picture formats with a header/descriptor approach allow the inclusion of both 1050 and 787.5 raster formats. Progressive scanning and square pixel capabilities are provided in both raster formats. Interlaced scanning and rectangular pixel formats are also provided.

- The video compression approach has substantial commonality with MPEG-2 using the MPEG-2 syntax but with additional syntax elements that represent innovative contributions from each previously proposed system.

- A packetized, prioritized data format will be used to provide flexibility of services and extensibility.

While rapid progress has been made in combining the best features of all forerunner systems, not all aspects of the Grand Alliance system have been finalized. In particular:

- Multi-channel surround sound audio will be used, but a decision among Dolby AC-3, multi-channel MUSICAM, and MIT-AC has not yet been made.

- The transmission approach has not yet been chosen. Candidate approaches include QAM, Spectrally-Shaped QAM, 6 VSB (with trellis code) and 4 VSB. A thorough analysis of service area, interference characteristics, transmission robustness and system attributes will be performed to determine the best approach.

The Grand Alliance system combines the best features of all previously proposed systems. It is a combination of elements tested and proven at the ATTC, and elements described in the proponents system improvement documents submitted in November 1992. The members of the Grand Alliance are confident that the performance of the Grand Alliance system will substantially exceed the performance of any individual system that was tested by the Advisory Committee. Details of five key areas of the Grand Alliance system are attached.

1. SCANNING FORMAT GRAND ALLIANCE TECHNICAL PROPOSAL

Baseline System	1. The Grand Alliance system will be a multiple format system supporting the following: 1050/1:1/30, 24 787.5/1:1/60, 30, 24 1050/2:1/60 2. Square pixels as well as lower horizontal resolutions for all formats are supported. 3. Grand Alliance members agree that large-screen HDTV receivers (34 inches in diagonal and above) will incorporate a 60 frame per second 787.5 line or higher progressive screen display mode. Grand Alliance members will seek committments from other manufacturers. 4. Transmission of 24 and 30 frames per second film material will be in a progressive scan format.
Rationale	1. The system provides multiple formats to support practical implementations during startup of the service, and yet anticipate the longer term convergence of entertainment television with computers and telecommunications. The long term standard will be built around a family of 1050 line progressive formats, at 60, 30, and 24 frames per second. 60 frames per second is not practical in the near term. To insure that practical modes exist for live video, 787.5 line progressive format and 1050 line interlace format will be supported initially. Grand Alliance members presume that the 1050 line interlace format will be phased out sometime in the near future, after which all transmissions will be progressive only. Multiple formats are supported also to permit a feature known as source adaptive coding which selects the optimal format for various source material. For example, 1050 line progressive format at 30 and 24 frames per second will be the preferred mode of operation for film originated source material, and 787.5 progressive format at 60 frames per second should provide the best performance for fast action video and graphics. 2. "Square pixels" along with progressive format is an important aspect of the system to insure interoperability with computers. When video source material does not require maximum horizontal resolution, the system permits significant portions of the total data capacity to be used for ancillary data services.

Rationale (Cont'd)	3. Incorporation of progressive format eliminates interline flicker sometimes associated with large screen receivers. 4. Film material is progressive in nature, and can be compressed more efficiently and provide better picture quality when transmitted in progressive format.
Open Issues	1. Interrelationship of transmission formats with production, contribution and distribution. 2. Migration path to 1050/1:1/60.
Resolution of Open Issues	A Grand Alliance specialist group on scanning format has been formed to address the open issues.
Schedule	Issues affecting the system design are to be resolved by September 15, 1993.

2. VIDEO COMPRESSION GRAND ALLIANCE TECHNICAL PROPOSAL

Baseline System	The Grand Alliance system will use MPEG-2 syntax with the following features: No B frames Field/frame coding I and P frames Progressive refresh Additional syntax elements: Frequency dependent leak Adaptive 8x8 inter/intra Encoder prototype implementation features: VQ for selection with perceptual coding Predicted frame motion estimation Large range hierarchial motion estimation
Rationale	The system blends together key features from each of the four proponent systems. Use of MPEG-2 syntax will make the system more acceptable as a world-wide HDTV standard, and will help IC manufacturers develop video decoder VLSI. Further, interoperability of compressed bit streams will be enhanced. B frames are not included in the baseline system as it adds to complexity and channel acquisition delay. Additional syntax elements are needed to support the features not included in MPEG-2.
Open Issues	The following proposed improvements to the baseline system will be evaluated: B frames Coefficient selection coding Non-uniform quantitization with new VLC's
Resolution of Open Issues	A Grand Alliance specialist group on compression has been formed to assess system performance and the proposed improvements.
Schedule	The Grand Alliance will decide whether the improvements are justified for inclusion in the final system by September 30, 1993.

3. TRANSMISSION GRAND ALLIANCE TECHNICAL PROPOSAL

Baseline System	The Grand Alliance System will use one of the following: 4VSB 6VSB 32 QAM 32 SS-QAM
Rationale	The transmission systems (4VSB, 32 QAM, 32 SS-QAM) used in the four proponent systems worked very well. Additional improvements have been incorporated yielding even better performance. 6VSB is a trellis-coded version of 4VSB.
Open Issues	A selection needs to be made.
Resolution of Open Issues	A Grand Alliance specialist group on transmission has been formed to: 1. Make a decision based on paper analysis using technical attributes/parameters and weighting factors. Use updated/improved PS/WP-3 computer programs to calculate ATV coverage area and NTSC service area loss. 2. Carry out simultaneous hardware testing in case a decision can not be made based on the paper analysis.
Schedule	The Grand Alliance will make a selection by November 30, 1993.

Baseline System	The Grand Alliance System will use one of the following: Dolby AC-3 Multi-channel Musicam MIT-AC
Rationale	A multi-channel audio system is needed to meet the requirement of ATSC T3/186. Since there has been no formal testing done on multi-channel audio systems, there is no clear basis for decision now.
Open Issues	A selection needs to be made.
Resolution of Open Issues	A Grand Alliance specialist group on audio has been formed to: 1. Analyze system performance and cost including compatibility and interoperability, and fit to the requirements of ATSC T3/186. 2. Carry out simultaneous testing. 3. Make a decision based on cost/performance trade-off.
Schedule	The Grand Alliance will make a selection by August 31, 1993.

5. TRANSPORT FORMAT GRAND ALLIANCE TECHNICAL PROPOSAL

Baseline System	The Grand Alliance System will use a packetized, prioritized data format.
Rationale	Packetized, prioritized data format, including headers and descriptors, is required to insure maximum flexibility and extensibility.
Open Issues	Transport layer needs to be defined in detail.
Resolution of Open Issues	A Grand Alliance specialist group on transport has been formed to define the transport format. The group will coordinate existing work, e.g., SMPTE.
Schedule	The Grand Alliance will define the transport format by August 31, 1993.

TS-004

Docket 87-268

Advisory Committee on Advanced Television (ATV) Service

Dear Grand Alliance Technical Committee Member, June 8, 1993

Attached hereto for your review are the comments and questions on the Grand Alliance Technical Proposal from members of the ACATS Technical Sub-Group, the Ex-officio participants, and the Official Observers.

In preparation for the first Technical Sub-group meeting June 30 and July 1, 1993; please review these documents and be prepared to adderss the various points during your initial presentation on June 30.

Thanks for your cooperation.

Sincerely,

J. A. Flaherty
Co-Chairman ACATS
Technical Sub-group

Distribution: Messrs. Carlo Basile, R. L. Cerbone, Jae Lim, Wayne Luplow, Robert Rast,

CC: Messrs. Lynn Claudy, Birney Dayton, Erwin Dorros, Alex Felker, Branko Gerovac, Michael Haley, John Henderson, Robert Hopkins, Renville McMann, Mark Richer, Robert Sanderson, Craig Tanner, Victor Tawil, George Vradenburg III, Richard E. Wiley

Ex-Officio Participants - Messrs. Robert Bromery, Peter Fannon, Reggie Gilliam, George Hanover, Paul Hearty, Brian James, Richard Prodan, Charles Rhodes, Peter Smith, James Gaspar

Official Observers - Ms. Carol Darling, & Messrs. Ken Davies, Howard Miller, Keiichi Kubota, Victor Rojas.

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June 11, 1993

Dr. Joseph A. Flaherty
Co-Chairman, Technical Subgroup
CBS Inc.
51 W 52 Street
New York, NY 10019

In response to your memo requesting written submissions for the "Grand Alliance" Technical Committee, I wish to offer the following list of questions:

1. How will a display device operate in the 6 format environment proposed? (a block diagram is required)
2. Will multiple clock frequencies be required?
3. Will backward compatibility from the target 1050/1:1/60 format be built into the early receivers and other display devices?
4. What is the horizontal pixel number in the 1050 family of formats?
5. With progressive refresh and no B frames is there a difference between I and P frames?
6. What is frequency dependent leak?

Sincerely

Jim Gaspar

James A. Gaspar
Chairman, PSWP6

JAG/tb

Renville H McMann Jr
963 Oenoke Ridge
New Canaan Ct 06840

21 June, 1993

Questions for the Grand Alliance:

1. What are the horizontal pixel counts for each format?

2. Will all receivers, even those less than 34", be required to display all formats as best they can by switchable scan rates or digital conversion at the receiver?

3. How do the proponents expect to get to 1050 lines Progressive within the 6 Mhz terrestrial channels if they can barely do 787.5 lines today?

4. If the proponents expect to phase out 1050 lines Interlace "in the near future", will they do the Interlace job properly?

5. What is the approximate relationship between a reduction in horizontal resolution and increased ancillary data service?

6. MPEG2 is supposedly compatible with MPEG1. Will this be true with the proposed system, i.e will it decode MPEG1, CDI, etc?

7. Who will do, and where will they do, the testing of the supposed improvements to MPEG2?

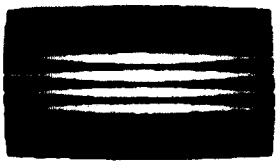
8. Has COFDM been considered for transmission? Have any of the proponents been tracking the proposed tests of COFDM?

9. Who will do the audio compression testing. It should probably not be the proponents by themselves. Is the ATT system going to be considered?

10. Will there be any provision for multiplexed 525 line pictures?

11. Has the inclusion of inter-operability, packetization, etc. caused any significant loss in terrestrial transmission quality?

12. What are the implications of having dropped the B frames?



Robert Hopkins
Executive Director

June 18, 1993

Mr. Joseph A. Flaherty
Sr. Vice President, Technology
CBS, Inc.
51 West 52nd Street
35th Floor
New York, NY 10019

Dear Joe:

I have attached my comments and questions regarding the Grand Alliance Technical Proposal.

Sincerely yours,

Robert Hopkins

COMMENTS AND QUESTIONS
GRAND ALLIANCE TECHNICAL PROPOSAL

Robert Hopkins

1. SCANNING FORMAT

The Grand Alliance Technical Proposal states that the system supports the following scanning formats:

1050/1:1/30, 24
787.5/1:1/60,30,24
1050/2:1/60

Question: In the rationale it is stated that the long term standard will be built around a family of 1050 line progressive formats at 60, 30, and 24 frames per second, but 1050/1:1/60 is not shown in the table. Why is 1050/1:1/60 not listed?

Question: How many active lines and active horizontal picture elements are supported in each format?

It is my strong view that the supported scanning formats should be as follows: {Note the symbolism of V x H x S x R where V represents active lines per frame, H represents active horizontal picture elements, S represents scanning (interlace or progressive), and R represents picture rate (fields per second for interlace or frames per second for progressive).}

720 x 1280 x 1:1 x 60/30/24
1080 x 1920 x 1:1 x 60/30/24
1080 x 1920/1440 x 2:1 x 60

The proposal substitutes a scanning format based on 1080 active lines for the Grand Alliance Technical Proposal scanning format based on 1050 total lines. The reasons for this substitution are as follows:

1) The target production standard for the United States being developed by the ATSC is based on 1080 x 1920 x 1:1 x 60. The future target for a broadcasting standard should not be based on a lower set of numbers.

2) 1050 total lines will not receive support as an international standard while 1080 active lines does have international support.

3) 1050 total lines does not support a resolution "greater than 1000 active lines" which has been the target for HDTV for many years.

4) A simple integer relationship of 2:3 exists between 720 x 1280 and 1080 x 1920.

5) 960 active lines cannot support square pixels (precisely) with a 16:9 aspect ratio because 960 is not a multiple of 9.

In the case of interlaced scanning, I propose that at least two different horizontal resolutions be supported, 1920 and 3/4 of 1920, or 1440 (1680, which is 7/8 of 1920, might be worth consideration also). If one assumes the Kell Factor decreases the vertical resolution to about 75% of 1080, it seems reasonable to decrease horizontal resolution to 75% of 1920, or 1440, to decrease the data rate to allow implementation of a practical system for a startup service.

Question: Is there a reason 1080 x 1920 x 1:1 x 60 should not be the target for the ATV broadcasting service?

Question: Is 1080 x 1440 x 2:1 x 60 a practical system for a startup service?

The Grand Alliance Technical Proposal states that transmission of 24 and 30 frames per second film material will be in a progressive scan format. This probably does not mean that display of the film material in the consumer receiver will be 24 or 30 Hz progressive, but rather that it will be displayed at 60 Hz in a progressive manner or by simulating the 3:2 pulldown in the receiver. This may have implications in receiver cost.

Question: Does transmission of 24 and 30 frames per second film material result in increased cost for receivers? Is more memory required in the receiver? If there is a cost increase, how significant is it?

The Grand Alliance Technical Proposal states that the migration path to 1050/1:1/60 is an open issue. However, it is a very important issue and cannot be left to chance in the future.

Question: Will the migration path to the future target system be resolved by September 15, 1993? Will it be understood and taken into account in the startup service? Is the migration path more difficult or critical at the encoder end or the receiver end? Is the migration path easier for receivers which are based on 720 x 1280 x 1:1 or 1080 x 1440 x 2:1? Will early receivers become unusable after the migration?

2. VIDEO COMPRESSION

The Grand Alliance Technical Proposal states, "The Grand Alliance system will use MPEG-2 syntax ..." This seems a very good idea. MPEG-2 is receiving international support for use in broadcasting systems. Indeed, the Proposal also states, "Use of MPEG-2 syntax will make the system more acceptable as a world-wide HDTV standard, and will help IC manufacturers develop video decoder VLSI." However, the Proposal also states, "Additional syntax elements are needed to support the features not included in MPEG-2."

Question: Does the Grand Alliance plan to argue that MPEG should include such features in MPEG-2? Assuming this is the case, when will the Grand Alliance be prepared to present the arguments to MPEG? If MPEG does not agree to include the features, would the Grand Alliance drop the features? If MPEG does not include the features and if the Grand Alliance does not drop the features, would this preclude the use of MPEG-2 decoders?

3. TRANSMISSION

No comments or questions at this time.

4. AUDIO

No comments or questions at this time.

5. TRANSPORT FORMAT

A packetized, prioritized data format, including headers and descriptors, is included in the Grand Alliance Technical Proposal. This is an area which has been described by many, including members of the EBU and the CCIR, as the area which is most likely to lead to world-wide commonality. The Grand Alliance schedule says the transport format will be defined by August 31, 1993. The full technical proposal should be made available as soon as possible after that date because many people will be anxious to study it in detail.

ADVANCED TELEVISION TEST CENTER, INC.

1330 BRADDOCK PLACE · SUITE 200 · ALEXANDRIA, VIRGINIA 22314-1650
703/739-3850 · FAX 703/739-3230

June 18, 1993

VIA TELECOPIER

Mr. Joseph A. Flaherty
Co-Chairman, Technical Sub-Group
FCC Advisory Committee on Advanced
Television Service
c/o CBS Inc.
51 West 52nd Street
New York, New York 10019

Dear Joe:

This responds to your June 7 request for comments and questions on the 'Technical Proposal' of the Grand Alliance in advance of the the Technical Sub-Group's meeting of June 30-July 1, 1993.

Inasmuch as there is little specific information on the 'new' ATV system design at this stage, we would hope that the opening part of this first review session will be devoted to a more detailed system presentation by the Alliance members. This will help the proponents prepare the detailed technical description which we understand the Advisory Committee has asked be provided promptly after this 'preliminary review' session at the end of this month.

And, both the presentation now, plus that detailed submission, will also help the Technical Sub-Group prepare for its second session in July. We believe that this second session should combine the goals of the original 'hell week' and the two-step 'certification' evaluations. This would be the time to delve into specific questions about the detailed technical description, all aimed at learning what's real for the near-term, what's not, what's coming for test and when. Finally, given the performance levels of the original, individual systems tested, this will also be the time to determine on paper whether the planned new ATV system is indeed likely to be 'greater than the sum of its parts' or, as per the discussion and findings of ACATS in February, "better than any [original] single system as improved." Such an approach will help speed the ATV system approval process, define the future work of the Sub-Group (*e.g.* sub-system and/or progress reviews), and aid the ACATS Working Parties and testing laboratories which must draft and organize for

the final test plans and procedures on a schedule parallel to the construction of the approved ATV system.

With this approach in mind, and given that the decision schedule outlined by the proponents specifies five key areas where choices of sub-systems are not planned to be made until during August-November 1993, we would suggest three areas of inquiry at this stage, which we feel should be pursued at the first review meeting:

1. Relationship of the System to be Delivered for Final Testing (and Standardization) and Future System Developments/Improvements.

Proponents have outlined plans for a six-mode transmission system, which apparently would encompass both interlace and progressive techniques and which would move to a higher line-rate, progressive-only system. In Congressional testimony to date, representatives of the Alliance have also represented that the new system will be capable of providing either HDTV--consuming most of the available bit stream--or some number of less-than-HDTV quality programs and/or data services.

It is important for the Alliance to specify what will be provided in their system implementation now (*e.g.* for the ACATS process 1993-94), and what will come later. There should be some explanation as well of both how future targets/plans eventually would be added onto the near-term system and a projected timetable for developing and implementing those elements in light of current knowledge and plans of the Alliance.

2. Relationship of Transmission System Plans to Current and Future Display Technologies.

The new ATV system anticipates the need to accommodate the shift from primary reliance on current CRT (direct view and projection) displays to the introduction of new, flat-panel display technologies as well. Together with the increased demand for interoperable functionality with the computer domain, these shifts add new dimensions to the cost/complexity of any system.

Given the need for the Advisory Committee, as part of its standards recommendations to the FCC, to reassess its cost-to-users/consumers projections and its implementation-transition scenarios, the proponents should describe their view of how different transmission-display relationships will be accommodated in their original design and then in their future, system evolution planning.

3. ATV System Testability--Overall Performance, Sub-System Performance, and 'Future System' Performance.

Many decisions are still to be made about the component parts and the integration of them into a full new ATV system. Given the findings of the tests on the original, separate systems, however, and the fact that some parts of the new system may not be 'as originally tested', development of an appropriate, comprehensive test plan should start now and parallel the design and implementation of the system itself. It must also be determined whether there will be 'system only' testing--largely, as in the past--or also sub-system testing (*e.g.* packet robustness, header/descriptor success, data trade-offs, etc.). This means that ACATS and its testing laboratories must know which transmission and display formats are to be provided--thus tested--inasmuch as testing must verify for each format such things as the RF envelope for ATV-into-NTSC interference, minimum C/N (C/I), transient peak-to-average power ratio, subjective evaluation of picture quality, etc.

Developing the most efficient test plans and procedures, thus the speediest and most reliable results at the lowest cost, will depend on specifying the testing requirements as early as possible, with both the near-term and long-term ATV system designs in mind.

* * *

We hope these preliminary comments are helpful, and we look forward to working with the Technical Sub-Group and the members of the Grand Alliance to complete the review and plan for the best testing of the unified ATV system.

Sincerely,

Peter M. Fannon
Executive Director

Charles W. Rhodes /pmf

Charles W. Rhodes
Chief Scientist

cc: Richard Wiley, ACATS

June 17, 1993

To: Dr. Joseph A. Flaherty
From: John G.N. Henderson
Subject: **Comments & Questions on Grand Alliance Technical Proposal**

General Comments:

The information presented in this Technical Proposal is very sketchy and raises many questions. I will try to keep most of my questions for this first round of discussions correspondingly general.

As it stands, the document is very inclusive of features from all the digital systems tested. The preamble claims this is its strength ("combines the best features....."). This inclusiveness can also be its weakness if it reflects avoidance of hard choices and if its multiple options add complexity and cost for no discernible improvement in image and sound quality.

I suggest that the Technical Sub-Group encourage the proponents to avoid the easy path of all-inclusiveness. Multiple coding options should be included only if there is a clear benefit in picture quality. Otherwise, we simply make HDTV more costly. If need be, I believe the Technical Sub-Group can and should give strong guidance, supported by its own analysis and testing.

Specific Questions & Comments:

SCANNING FORMAT

1. Supporting both 1050/2:1/60 and 787/1:1/60 requires that receivers have both the highest image storage capacity and the highest pixel rate, as the following arithmetic shows.

   Assuming 1.5 x 8 bits/pixel for luma and chroma in 4:2:0 mode, the storage requirements are:
   Progressive: 720 x 1280 x 8 x 1.5 = 11.06 Mbits/frame
   Interlaced: 960 x 1440 x 8 x 1.5 = **16.59 Mbits/frame**

   The required rate at which 8-bit DCT coefficients must be handled is:
   Progressive: 720 x 1280 x 1.5 x 60 = **82.94 x 10^6 coeffs./sec.**
   Interlaced: 960 x 1440 x 1.5 x 30 = 62.21 x 10^6 coeffs./sec.

While supporting all the modes is clearly possible in a receiver, it does increase cost and complexity. In particular, the high rates for the DCT coefficients may increase the design difficulty for the variable length decoder. Are all these modes justifiable in terms of image quality vs. cost? Will there be any restrictions on the "burst" data characteristics of the encoder in order to simplify the decoder?

2. Are the frame rates really 60 fps and 30 fps instead of 59.94 fps and 29.97 fps?

3. How are the pixels arranged to create square pixels in the interlaced system? 810 vert x 1440 horiz? Will square pixels be required, or will the resolution of the 1050/2:1/60 system be 960 vert x 1440 horiz, or will it be something else? Are receivers expected to support all of these arrangements (in addition to both interlaced and progressive scan)?

4. What are the purposes of the "lower horizontal resolutions"? Is this intended to allow softer images that are easier to code or will it be combined with lower vertical resolution to permit (arbitrarily) small pictures? If the latter, will the data stream suggest whether the image should be scaled up or not? Should we be evaluating such formats for broadcast applications? If the intent is to permit arbitrary image sizes, then this will increase receiver complexity.

5. The Alliance members have agreed that large-screen HDTV receivers will include a progressively scanned mode. Is this progressively scanned mode intended as a requirement or a recommendation? Consumers and receiver manufacturers are both served better by marketplace choices among price and performance than by arbitrary legislation unsupported by compelling need. I suggest that the multiple format options available for transmission also be available for receiver display. If any mode offers performance advantages that consumers perceive, it will be manufactured.

VIDEO COMPRESSION

1. Many compression techniques are presented. How will encoders select among them? Is it anticipated that all encoders will support all options, or will different applications or even different broadcasters select different encoders?